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1 author:

Stephen Ralston
National Oceanic and Atmospheric Administration

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STEPHEN RALSTON*

Southwest Fisheries Science Center, Santa Cruz Laboratory, National Marine Fisheries Service, 110 Shaffer Road, Santa Cruz, California 95060, USA

Along the West Coast of the continental United States, which includes the states of California, Oregon, and Washington, the Pacific Fishery Management Council (PFMC) has the authority to promulgate fishery management regulations for salmon species, groundfish, coastal pelagic fish, and highly migratory stocks of fish within the Exclusive Economic Zone. That authority originated with the passage of the Magnuson−Stevens Fishery Conservation and Management Act of 1976, although all regulatory actions by the PFMC are ultimately subject to approval by the National Marine Fisheries Service. Since a functional management system was first implemented in the early 1980s, it has been the PFMC's practice to manage groundfish stocks using a quota system that requires scientific determination of an acceptable biological catch (ABC) and, based on that, an optimum yield.

Up until 1998, it was PFMC's policy to set the ABC of a groundfish stock by simply applying the fishing mortality rate that produces the maximum sustainable yield (F_{MSY}) to an estimate of exploitable biomass. Policies of this kind are termed constant-rate policies because, once F_{MSY} is determined, the annual ABC is strictly proportional to the estimate of exploitable biomass. However, owing to short data series and other technical issues, it generally was not possible to obtain reliable estimates of F_{MSY} for any groundfish stock. Consequently, during the 1980s and early 1990s, several surrogate or proxy estimates of F_{MSY} were commonly used (e.g., $F_{0.1}$ or the value of F that equaled natural mortality [M]).

Clark (1991) originally proposed $F_{35\%}$ as a general, rational surrogate. This is the fishing mortality rate that reduces the spawning potential per recruit to 35% of that of the unfished level. If fecundity is directly proportional to individual female weight, it is also the rate of fishing that reduces the spawning biomass per recruit to 35% of what it would be in the absence of fishing. Clark showed that this rate is easily calculated from basic biological information and that it produces a yield close to the MSY for a range of life history parameters and productivity relationships covering an array of well-studied groundfish stocks with long histories of exploitation, most of which are Atlantic stocks. He also showed that $F_{35\%}$ is very close to both $F_{0.1}$ and M when the schedules of recruitment and maturity coincide and that it is appreciably higher or lower when these schedules differ. In a second paper, he extended the original analysis to cases with random and serially correlated recruitment variation (Clark 1993) and, based on those refinements, concluded that $F_{40\%}$ is a better proxy for F_{MSY} than $F_{35\%}$. Mace (1994) also recommended the use of $F_{40\%}$ on the basis of deterministic calculations. Based on productivity determinations worldwide, the current scientific consensus is that $F_{40\%}$ is a reasonable harvest rate to use for stocks with unknown productivity parameters, at least in the initial stages of fishery development.

According to the prevailing theories of stock population dynamics, harvesting at a constant rate of F_{MSY} will cause the stock biomass (B) to approach an equilibrium point equal to B_{MSY}. Importantly, if the fishing rate is constant, the population's trajectory during the transition to this equilibrium will generally be asymptotic, with the expected annual decrement (or increment) in stock biomass declining progressively over time. While a stock fished persistently at $F_{40\%}$ will not necessarily approach the stock size producing the MSY, if the proxy harvest rate is reasonable it should lead to a biomass equilibrium somewhere in the range of 25–50% of the unexploited population level (B_0). That is why Clark (1991) suggested $B_{40\%}$[1] as a robust, alternative biomass-

* E-mail: Steve.Ralston@noaa.gov

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[1] $B_{40\%}$ is equal to $0.4 \cdot B_0$, that is, to 40% of the absolute unexploited population size. Note that $F_{40\%}$ is the fishing mortality rate that reduces spawning potential *per recruit* to 40% of that in the unfished condition. If recruitment is unaffected by fishing, a population will approach $B_{40\%}$ when fished at $F_{40\%}$; however, if recruitment declines due to fishing (a plausible scenario), the population will approach a biomass equilibrium that is somewhat less than $B_{40\%}$.

based proxy for guiding management in the absence of credible stock-specific information.

Declines of Pacific Coast Stocks Fished at $F_{35–40\%}$

During the mid-1990s, it became increasingly apparent that many groundfish stocks were not approaching an equilibrium above $B_{20\%}$. Ralston (1998) showed that a number of Pacific Coast rockfish *Sebastes* spp. stocks had declined to alarmingly low levels, contributing to concerns about the validity of the Pacific Fishery Management Council's use of $F_{35\%}$ as a proxy for F_{MSY}. His findings, along with analyses conducted during the preparation of Amendment 11 to the Groundfish Fishery Management Plan (PFMC 1998), led to a series of informal meetings focusing on the relative productivity of West Coast groundfish stocks.

Ultimately, owing to continued concern over declining trends in groundfish stocks and their apparent inability to sustain historical harvest rates, PFMC's Scientific and Statistical Committee (SSC) sponsored a formal workshop to evaluate the issue and make recommendations concerning the suitability of PFMC's default groundfish harvest rates (which in 1998 had been changed from $F_{35\%}$ to $F_{40\%}$ for *Sebastes* spp. but remained at $F_{35\%}$ for all other stocks). The West Coast Groundfish Harvest Rate Policy Workshop was held March 20–23, 2000, at the Alaska Fishery Science Center in Seattle, Washington. The meeting entailed 12 presentations by interested scientists to a panel consisting of three SSC representatives and three outside reviewers. The panel evaluated all of the material presented at the workshop as well as other information in the scientific literature and issued a report supporting the consensus finding that groundfish harvest rates should be reduced (S. Ralston et al., panel report in the minutes of the Scientific and Statistical Committee, 2000).

The papers presented here include all but two of the working documents that were prepared for the workshop. The broad range in topics addressed (e.g., meta-analysis, surplus production modeling, statistical bias, and discards) allowed a wide-ranging discussion of the issues, which were nonetheless focused on the appropriateness of existing harvest rates. Ultimately, PFMC adopted a revised set of harvest rates for West Coast groundfish that reflects the apparently low productivity of these stocks, at least over the last two decades.

Acknowledgments

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